

the labors of Bernard in France, Von Bezold, Böhm, Köhler, Schmiedeberg, Rossbach, and others, in Germany; to Brunton, Crum Brown, and Frazer, in England; Drs. S. W. Mitchell, Amory, and H. C. Wood, Jr., in this country.

I have appended here a table, showing approximately the soporific, convulsivant, and toxic relations of the elements of opium. They are arranged in the order of their strength. Some have been studied so little that their true place in the series cannot at present be definitely laid down.

Narcotic Effect.		Convulsivant Effect.	Toxic Effect.	
MAN.	ANIMALS.	ANIMALS.	MAN.	ANIMALS.
Morphia ...	Morphia....	Thebaine.....	Morphia ...	Thebaine.....
Codeia	Codeia	Laudanine	Codeia	Laudanine
Cryptopia ..	Cryptopia...	Laudanosine ...	Cryptopia ..	Laudanosine ...
Papaverine..	Narceine ...	Hydrocotarnine.	Thebaine ...	Hydrocotarnine.
.....	Meconine ..	Papaverine	Papaverine ..	Morphia
.....	.....	Narcotine	Narceine .....	.....
.....	.....	Codeine	Narcotine ..	.....
.....	.....	Morphine .....	.....	.....

ART. III.—THE COST OF CONSTRUCTING HOSPITALS FOR THE INSANE.

By I. RAY, M. D.

(*Read to the Convention of Superintendents of Hospitals for the Insane, held at St. Louis, June, 1877.*)

NOTWITHSTANDING our abundant experience in the building of hospitals for the insane, the prevalent notions respecting their cost are pervaded by a degree of vagueness and uncertainty hardly to have been expected from such experience. The fact is calculated to create a very unsatisfactory state of public feeling respecting the present methods of caring for the insane. Once, every State had come to the conclusion, in the fullness of time, that it was bound to provide for their

maintenance in buildings specially adapted to the purpose by their architectural arrangements, and various appliances understood to be conducive to the end in view. Of course this provision cost something, but the cost was kept so well within the limits of what seemed to be a proper expenditure, that fault was seldom found on that score. Of late years, however, without any diminution of interest in the purpose itself, but rather with an increasing disposition to fulfill its duties to this class of unfortunates, the public has begun to complain, in no gentle tones, that the cost of these establishments has often been carried to a pitch not required for the proper care and attentions for which they are designed, and seriously onerous to the taxpayer. And this has led to the idea that the greater part of the indigent insane can be comfortably provided for in a much cheaper kind of structure than those usually built. This idea, be it observed, rests on the fallacy that, because here and there a hospital has been built improvidently, therefore we should have few or none properly deserving the name. Under its inspiration some economical devices have been resorted to in one State or another, most, if not all of which, have strikingly illustrated the belief that there is no half way institution between a poor-house and a hospital. They show the operation of the inflexible rule that what is cheap in the beginning often proves dear in the end. If there is any lesson clearly taught by the experience of the last fifty years, it is that no really cheaper structure for the care of the insane of whatever grade, can be erected, than most of the State hospitals of our country. Occasionally, improper sites and injudicious contracts have carried the ultimate cost far beyond a suitable limit, but, with these exceptions, we believe the general rule to be as we have stated. As the matter now stands, it would seem that we have but one alternative—either to provide for our insane at a cost that would be a pretty high figure at a first-class hotel; or in structures so cheaply built as to entail a large annual expense for repairs and improvements, and wanting many of the arrangements now considered necessary in order to obtain the best results of hospital management. I do not believe, however, that we are really obliged to accept such an alternative. I believe that hospitals may be built wanting in

nothing conducive to the best results, at a cost which our people will cheerfully bear. Such hospitals have been erected, and I see no reason to doubt that they may continue to be. Of course, following the general rise of prices, they will cost more than they once did, but the means of the country have risen in a corresponding degree. In order to bring the present state of public opinion on this subject into a healthier tone, the first step is to show with some degree of precision, what a hospital for the insane properly provided for the purpose, and built as the humblest man governed by reasonable ideas of economy would build for his own habitation, should necessarily cost. And with this object in view, we can have no better guide than actual examples.

In 1846, the Butler hospital in Providence, R. I., with a capacity for 145 patients, was built at the cost of about \$130,000, or \$900 per patient. It is mostly of two stories, with rooms on only one side of the halls, and with enough of architectural adornment to distinguish it from a cotton mill or a county jail. As compared with many other hospitals, this might be considered a rather expensive style of building. On the other hand, it must be considered that the larger expense incurred by the arrangement of the rooms was offset by associated dormitories to a greater extent than is usual. The provision for ventilating and warming proved insufficient. Had it been made then as it was ten years afterwards, a farther outlay would have been needed of about \$100 per patient. Very little—less than \$1,000—was required for outbuildings to supplement those already on the place, and but little more in grading the grounds, making roads, etc. The land, consisting of 100 acres, cost \$6,000 only. In those days, hod-carriers got eighty cents a day, and men laid bricks for \$1.50. At present prices, the establishment must have cost a little more. Leaving out of the question the land, which would have cost \$50,000, (and consequently would not have been selected) we may safely put the additional cost at twenty per cent., making the average cost, in round numbers, \$1,200 per patient.

Four years ago, the capacity of the Pennsylvania hospital for the insane was enlarged by the erection of a new building, called the north Fisher ward. It is of two stories, with rooms

on both sides of the hall, provided with a boiler, engine and fan, and designed for thirty patients. The walls are rough-cast, the interior neatly and substantially finished, and nothing in the whole structure that could be dispensed with or changed for something cheaper, unless it may be a few wooden columns in the halls to give a little character to a recess, and which may have cost ten or fifteen dollars apiece. The cost of this building, including the arrangements for warming and ventilating, was \$39,457, or \$1,314 per patient. In this case, be it observed, there was no outlay for an administration building, nor for land, roads, grading, etc. Estimating the cost of these for a hospital of 400 patients at \$100,000, this, distributed pro rata, would raise the cost of this new building an additional \$7,500, or \$250 per patient, making the whole necessary average cost per patient, \$1,564. At the present scale of prices, the cost would have been some two or three hundred less.

The hospital now building at Warren, in Pennsylvania, intended to accommodate easily 600 patients, will cost, as the builder, Mr. John Sunderland, most confidently assures me, not over \$1,500 per patient. And this building is understood to be fire-proof.

The public has sometimes been misled, I apprehend, as to the proper cost of hospitals, by examples of the actual cost of buildings supplementary to establishments already in operation. There being no outlay for land, roads, or administration building, and but little for ventilation and warming, the cost of such supplementary buildings is confined almost wholly to masonry, joinery and plumbing, and here, too, the cost is greatly lessened if the patients are chiefly lodged in associated dormitories. Some four or five years ago, a new wing was added to the Government hospital at Washington, to receive 140 patients. Excepting eight single rooms, the dormitories are of the associated kind, and the stories are only ten feet high. But the building is provided with all the modern improvements, and to say that the work was directed and superintended by Dr. Nichols, is equivalent to saying that it was thoroughly done. Its cost was \$425 per patient.

Conversing on this subject with Mr. Samuel Sloan, an architect of this city, who is more familiar with hospital construc-

tion, I presume, than any other man in the country, he very kindly engaged to prepare for me a schedule of the various items of expense incurred in the establishment of a hospital for the insane, two stories in height, to receive 400 patients.

Land, 100 acres, at \$200 per acre.....	\$ 20,000
Bricks laid in wall, 12,000,000 at \$12 per m.....	144,000
Window and door heads, 900 at \$3 each.....	2,700
Window sills, 750 at \$3 each.....	2,250
Stone steps and door sills	4,200
Flagging for kitchen and laundry floors.....	1,000
Excavation, 120,000 yards at 25 cts., including grading.....	30,000
Plastering, 80,000 yards at 25 cts.....	20,000
Roofing, 75,000 feet at 12 cts.....	9,000
Conductors and underground drain pipe.....	3,800
Lumber, 900,000 feet, averaging \$30 per m.....	27,000
Window frames, 900 at \$4.....	3,600
Doors and frames, 650, averaging \$12.....	7,800
Carpenter work.....	36,000
Painting and glazing.....	14,000
Hardware, including nails and locks.....	3,800
Iron sash and guards.....	6,000
Slate stairs.....	3,500
Iron work.....	4,000
Heating, laundry, machinery and fans.....	28,000
Fixtures for kitchen and bakery.....	2,500
Gas works.....	14,000
Gas pipes and fixtures.....	7,000
Stone dressings for front door of centre building.....	2,000
Culvert for drainage.....	5,000
Farm house and stabling.....	12,000
Roads and walks.....	4,000
Exercising yards (enclosing).....	5,000
Entrance lodge.....	3,000
Water supply.....	15,000
Fencing 100 acres.....	7,000
Plumbers' work within the building.....	8,000
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	\$455,150
Add 10 per cent. for lee way.....	45,515
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	\$500,665

If connections between the wings are to be fire-proof, add to this five per cent. \$25,033, making \$525,698; or an average cost, per patient, \$1,314.25.

If the capacity be reduced to 300, the average cost will be increased eight per cent. = \$1,419.38. If it be reduced to 250,

the average cost will be increased ten per cent. = \$1,445.67. If it be raised to 500, five per cent. must be deducted, making the average cost \$1,248.53. If it be raised to 600, eight per cent. must be deducted, making the average cost \$1,209.11. If it be raised to 700, ten and a half per cent. must be deducted, making the average cost \$1,176.25. If it be raised to 800, twelve per cent. must be deducted, making the average cost \$1,156.53.

Very likely, in some of the particulars the cost is placed too low to be regarded as a fair average, while in others it may be too high, the under-estimate probably balancing the over-estimate. Most of the estimates will differ somewhat with the circumstances of the place and site, notably with the facilities for reaching the ground, the opportunities for drainage and a water supply, and materials on the place that are required in construction, such as clay, lime, sand, stone. Thus, the bricks used for the hospital now building at Warren, Penn., are made under the direction of the builder from clay and sand on the spot, and at a cost, I do not doubt, of 50 per cent. less than their price in the market. In the same way were obtained the bricks used in the Government hospital at Washington. At the Butler hospital not one new road was required, and most of the materials were water-borne from the premises of the contractor to within a few rods of the place.

It will be observed that these estimates of Mr. Sloan substantially agree with the result presented by the actual examples quoted, making due allowance for difference of prices at different periods. They show, beyond question, that a hospital embracing all the modern improvements may be substantially built, with a suitable amount of land, at a cost not exceeding \$1,500 per patient, its capacity being for about 300, which are as many, I believe, as any hospital should have. And they show that it cannot fall much below this, unless the site is remarkably favored in the manner just indicated. Any figure much less must lead to the suspicion of the sacrifice of some important features of construction, or of poor materials and work, or deceptive contracts.

These estimates ought to disabuse the public of another error most mischievously prevalent at the present time, viz.,

that large hospitals cost very much less than small ones. It will be observed that 500 patients can be provided for at an average cost of only \$171 less than 300, and that the whole range of difference between the cost of 250 and that of 800 is but \$289. I believe the public convenience is better served by more than that amount by small hospitals, in the smaller expense of transportation, not to mention just yet other considerations no less important. Not only so, but it has been found that communities avail themselves of the benefits of a hospital to an extent that is determined by their relative nearness to it. In the present disposition to build our hospitals of immense size, these facts should be duly pondered. And where the plan is adopted of having the different pieces of the building entirely separated from one another, the economical advantage is lost, and the cost of construction equals, if not exceeds, that of smaller hospitals otherwise built. That the cost of maintenance will be greatly increased, is a fact self-evident to those who have the slightest practical knowledge of hospital service.

Dr. Earle, in his last report, contrasts the cost of the Danvers hospital, now building in his State, which will reach the sum of \$3,600 per patient, with that of the Fife and Kinross asylum in Scotland, which was only \$688.92. The Doctor does not say that the former should have cost no more than the latter, but for anything he does say, that might be inferred. As I write with the single purpose of correcting some misconceptions in regard to so important an object as the care of the insane, a word or two on this matter may not be out of place. Without any particular knowledge of this Scotch asylum, I can only refer in a general way to some points that may account for the cheapness of its construction. In Great Britain a much larger proportion of the patients sleep, if they sleep at all, in large associated dormitories. Especially is this so in Scotland, unless they have greatly changed of late years. In the pauper department of the asylum at Morningside, near Edinburgh, with some hundreds of patients, thirty years ago, there were only about a dozen single sleeping rooms. This, of course, would make a considerable difference in the cost of construction, but surely, Dr. Earle would not advocate such an

arrangement with us. Twenty-five per cent. of our patients are full as many as can be properly placed in associated dormitories. It must also be considered that the cost of building in Great Britain is much less than it is in this country. I have good authority for saying that it is nearly, if not quite, fifty per cent. less. With such advantages as these, the Scotch asylum cannot properly serve as a standard of cost with us.

Why some of our hospitals have been built at an expense that reaches almost the incredible, is a question of the gravest import, because the answer to it may involve the weal or woe of our insane for generations to come. We may be quite sure that if it be clearly understood that hospitals are, hereafter, to cost \$3,600 per patient, the public will decline to build them, while we may be equally sure, I think, that upon the estimates given above, the public will willingly provide them as fast as they are needed. The circumstances which have led to a cost excessively large vary, no doubt, in different cases, and, therefore, can only be discussed in a general way.

Probably nothing has contributed more to bring about this lamentable result than the injudicious selection of the site. For this purpose, the common practice is for the executive, or the legislature, to appoint a Board of Commissioners, not one of whom, it may be, was ever in a hospital for the insane, except as a casual visitor, or, of course, has any matured ideas of the needs and purposes of such an institution; in short, as well fitted for the duty as if it were to plan a chemical laboratory or draft an ocean steamer. Starting with the popular notion of the most desirable quality in a site for public or private purposes, they are very apt to pitch upon one which commands a wide outlook over the surrounding country, and this implies, generally, the necessity of expensive roads, to say nothing of the waste of muscle, the danger in driving, and the great increase of cost incurred by raising everything and everybody to a higher level. In such situations cheap roads are out of the question; they must be made in the most substantial manner, so as to resist the action of storms and frosts. At the asylum building in Danvers, Mass., the roads required for its various purposes have cost over \$56,000. Sometimes a large expense is incurred in shifting earth, removing boulders, and preparing

the grounds,—so great, it may be, that it should have been a fatal objection to the site. At Danvers, this amounted to nearly \$50,000. Not very unfrequently a site is chosen which is destitute of a sufficient water supply. The little stream which was to furnish an abundance of the needful element is found to be dry in the summer months; or the well, thought worthy of the utmost trust, proves by assiduous pumping barely adequate to the wants of a small family. To supply this deficiency has sometimes required an outlay which would once have almost built and equipped a small hospital.

All those worthy people who derive their notions of the enormous cost of hospitals from the reports of State Boards of Public Charities and equally reliable sources of information respecting hospitals for the insane, will expect to hear much in this connection of their palatial grandeur and extravagant ornamentation. That money has been sometimes spent for unwise and needless show, I would not deny. I simply say that this is not the sole source of excessive cost. Our State hospitals, in outward show and inward finish, are mostly destitute of any pretensions to grace and beauty, except what may be signified, perhaps, in a leaky cupola, or a wooden porch over the front door. Indeed, the fault has always been the other way, and it is one of no trivial importance. Not only good taste, but good sanitary results require that the architectural aspects should be in harmony with the special purposes of a hospital for disordered minds. The moral impression first produced thereby may be the first step that costs, in one direction or the other. It is exceedingly important that the patient, as he approaches the hospital, should not have those fears and suspicions so common with the insane confirmed by the sight of architectural arrangements which remind him only of places of penal confinement. To give it a distinctive character by architectural devices that need cost but little, is to promote the very purposes of the institution, and therefore, it is money well spent. For the same reason it is well to give the interior a more genial aspect than it often presents, by features as nearly as possible like those of a domestic residence. The constant sight, day after day, hour after hour, of a monotonous range of white walls, unrelieved by a

cornice, or a bit of paint, or a visible door frame, is well calculated to strengthen depression and multiply morbid fancies. Our predecessors made the mistake of supposing that such things are of no account in the management of the disordered mind, but they acted up to their light, while we, knowing their value, make the mistake of grudging the money they would cost.

Among the most fruitful sources of excessive cost in building hospitals are, I apprehend, a lack of well-conceived, well-matured plans; specifications lacking in accuracy and exactness, and contracts inconsiderately made and imperfectly executed. In this way, outlays are made not expected at the start, contingencies arise that were not anticipated, and improvements are suggested as the work goes on, which are deemed too valuable to be lost. To prevent all this, the plans should be approved, if not devised, by persons who have a practical knowledge of the requirements of such buildings; the specifications should be carefully and skillfully drawn, and the contracts controlled by an intelligent, practical builder, unhampered by "lowest bidders," and unbiased by pecuniary interests.

This inquiry warrants the conclusion that, avoiding on the one hand, a style of construction more extravagant than is needed for any rightful purpose, and on the other, a sort of false economy which leaves a large margin for future repairs and improvements, State hospitals for the insane may be established in our country, at an average cost per patient ranging from \$1,000 to \$1,500.
